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(54) Manufacture of concrete products

(57) In the manufacture of concrete slabs vibratory tables T_1 and T_2 are positioned at pouring stations S_1 and S_2. Hoppers H_1 and H_2 adapted to discharge measured quantities of cement mixes are respectively positioned at the stations S_1 and S_2, and moulds M are moved along the line in the direction of arrow A. Whilst a mould M is at the station S_1 a measured first mix is dumped into the mould from the hopper H_1. Table T_1 is then vibrated briefly to give a good face and the desired evenness of distribution of plastics beads or granules contained in the mix. After completion of vibration the mould M moves on to the table T_2 and at station S_2 a smaller quantity of a second mix consisting of cement and "finings" only is dumped from the hopper H_2 into the mould, following which the table T_2 is vibrated for another brief period.

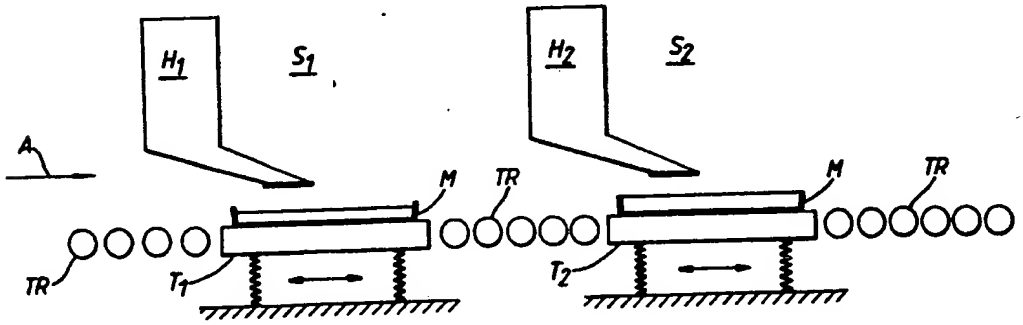

Fig.1.

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The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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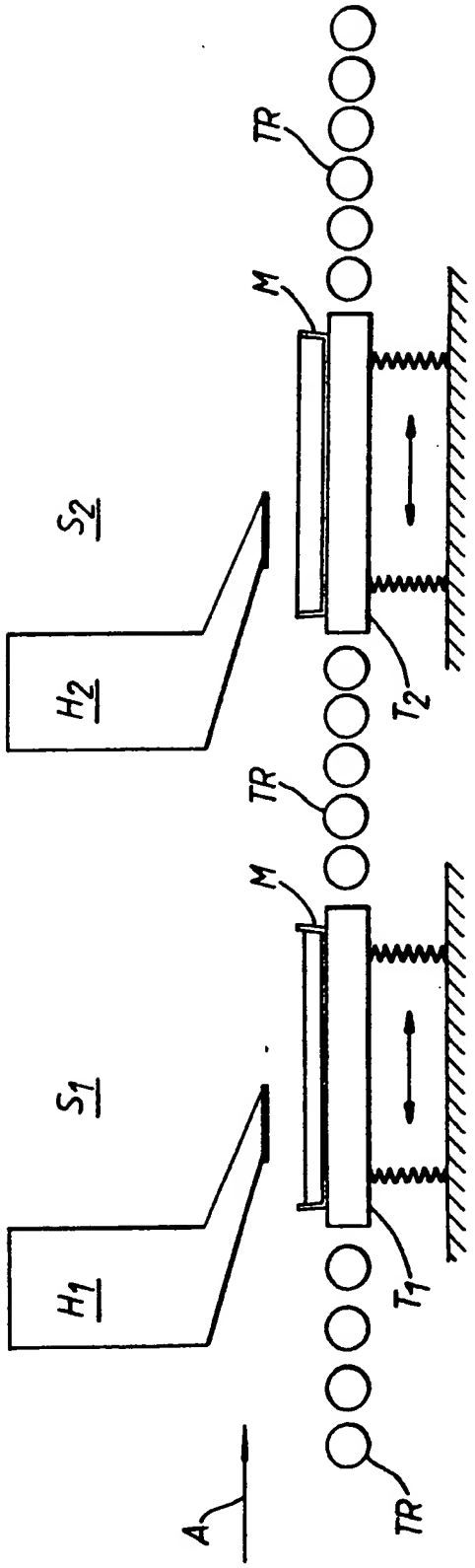

Fig. 1.

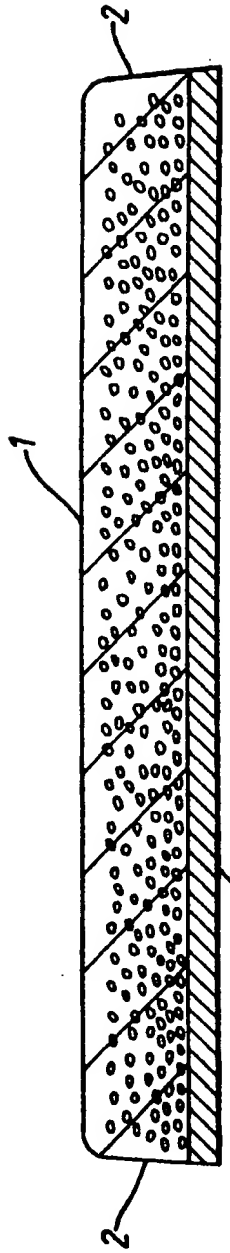

Fig. 2.

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"MANUFACTURE OF CONCRETE PRODUCTS"

The invention relates to the manufacture of concrete products, specifically concrete slabs and blocks cast from a cementitious mix and as used for paving, wall cladding, the building of ornamental walls and the like. It provides an advantageous method of manufacturing such products, and the resultant products.

The slabs and blocks at present available all suffer from the disadvantage of being extremely heavy in the standard sizes in which they are cast. Thus they are difficult and expensive to handle and transport. For example, standard paving slabs have a weight of 73 to 81 kgm per square metre, with a slab of 600 mm x 600 mm having a typical weight of between 27 and 29 kgm, and the handling of such slabs frequently results in injuries. In addition to back injuries resulting from handling the heavy slabs, the latter have an inherent weakness such that they can fracture whilst being handled with the heavy pieces dropping on to legs and toes.

Various proposals have been made for the manufactur of lightweight concrete cast products, such as slabs, but non of them has become stablished as a

satisfactory alternative to the conventional product cast from a normal cement/aggregate mix despite the w ight and other disadvantageous features thereof.

The invention has for its aim to provide lightweight cast products in a cost effective and otherwise advantageous manner and to this end, in accordance with the invention, a method of manufacturing such products comprises at least partially filling a mould with a mix comprising cement, aggregate and a substantial proportion by volume of lightweight non-absorbent plastics beads or granules, vibrating the mould to provide a good distribution of the beads or granules with a good face where contacting the mould surface, and thereafter providing a coating for the reverse face of the moulding.

Preferably said coating is a further layer of a cement/aggregate mix (ie without the plastics beads or granules) cast on said reverse face and the mould thereafter again vibrated to provide a good rear face. In a slab, for example, the first mix (including the plastics beads or granules) may fill about 80 % of the mould and the second mix (without the plastics beads or granules) the remaining 20%. The vibratory periods are chosen to provide the desired distribution of the plastics beads or granules and the desired surface finishes, but typical vibration periods are of the order of 5 seconds. The aggregate used for each mix is conveni ntly the semi-waste material supplied by the sand/gravel industry in South East England

under the designation "finings" which is grit with a large proportion of smaller particles and a maximum particle size of about 6 mm. The plastics beads or granules are preferably expanded polystyrene granules which, like the "finings" are readily and cheaply available.

Whilst the actual constituents of the mixes may vary according to desired properties of the finished product, an average first mix might comprise 40% by volume of polystyrene granules added to 8.5 kgm cement and 30 kgm "finings" per square metre of slab surface. Similar relative proportions of the cement and finings, but without the polystyrene granules, may be used for the second mix providing the rear surface layer.

As an alternative to the poured second mix rear surface layer, this layer may be applied by a tamping process although this requires the use of somewhat more elaborate machinery. Another alternative is to coat the rear surface of the slab with a layer in accordance with the surface bonding method which is disclosed in UK Patent No 2 166 664, to the specification of which reference should be made.

The invention includes cast products produced by the foregoing method and having a main body provided by said cementitious mix comprising cement, aggregate and non-absorbent plastics beads or granules.

The invention will now b further describ d with reference to the accompanying diagrammatic drawings which

illustrate a preferred m thod of manufacture, and the finished product, in accordance with the invention. In th drawings:

Fig. 1 illustrates the the manufacturing method; and

Fig. 2 is a cross-sectional view of the resultant paving slab.

Fig. 1 illustrates a production line for the manufacture of slabs, comprising two vibratory tables T1 and T2 positioned at pouring stations S_1 and S_2 and transfer rollers such as TR. Hoppers H_1 and H_2 adapted to discharge measured quantities of the cement mixes contained therein are respectively positioned at the stations S_1 and S_2, and moulds M are moved along the line in the direction of arrow A pausing at the stations S_1 and S_2 as shown. Whilst a mould M is at the station S_1 a 'measured' first mix is gravity dumped in the mould from the hopper H_1 using the largest practicable pouring aperture in relation to the mould size. Table T_1 is then vibrated briefly, typically for about 5 seconds, to give a good face and the desired evenness of distribution of the plastics beads or granules contained in this first mix.

The mix used is chosen to provide the desired characteristics for the finished slab, but an average mix might consist of 40% by volume of expanded polystyrene granules added to 8.5 kgm of cement and 30 kgm of "finings" per square metre of slab surface. Because the lightweight granules tend to float to the reverse side of th slab

during vibration, in order to produce an acceptable slab both the viscosity or 'flow' of the mix and the vibration of the table T_1 require careful quality control. After the completion of vibration the mould M moves on to the table T_2.

After the vibration at station S_1 the density of the granules is greater towards the top, ie the reverse face of the moulding. At station S_2 a small measured quantity of a second mix consisting of cement and "finings" only is dumped from the hopper H_2 into the mould, following which the table T_2 is vibrated for another brief period, again typically for about 5 seconds. As an example the first mix poured at station S_1 might fill say 80% of a mould M whilst, whilst the remaining 20% of the mould is filled at station S_2.

It will be appreciated that a sequence of moulds M is passed along the production line, each pausing at the stations S_1 and S_2 in turn only for a time sufficient for pouring of the respective mixes and the subsequent vibration. Whilst one mould M is being vibrated at station S_2 a following mould is being vibrated at station S_1.

The resultant slab, after initial curing and removal from the mould, is as shown in cross-section in Fig. 2. The slab has good top and side faces, 1 and 2, resulting from the vibration in the mould, and a back face 3 produced from th second mix and without expos d polystyr n granules. The slab is typically about 50%

lighter than conventional slabs, due to the incorporation of the lightweight polystyrene granules, and is also markedly stronger whilst a faster production time can be achieved.

The reason for the increased strength is that as the granular structure provided by the plastics granules is non-absorbent the first mix can have a relatively small water content. It is well known that the less water used in a cement mix the stronger will be the final product after curing. The use of the semi-waste "finings" material which is lighter (as well as cheaper) than the aggregate normally used also allows a strong cement mix to be employed, and it assists both in the aim of keeping down the weight of the slab and in the distribution of the plastics granules throughout the mix during vibration.

The use of a strong mix, plus the fairly regular distribution of the plastics granules with the fine aggregate, gives a strong and lightweight granular construction whilst retaining a good face for the slab. The use of a strong dry mix also reduces the curing time in the moulds, allowing more rapid turn around of the latter and speeding up the production process.

Not only are the slabs cheaper to produce, and easier and cheaper to handle, but transport costs are also markedly reduced. Reduction of weight by 50% doubles the quantity of slabs which can be carried on a lorry, and the slabs ar asily packed in plastics straps r polythen

packs. Furthermore there is less wastage due to fracture during handling and transit, as a result of the lighter weight and increased strength.

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CLAIMS:

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1. A method of manufacturing a lightweight cast product comprising at least partially filling a mould with a mix comprising cement, aggregate and a substantial proportion by volume of lightweight non-absorbent plastics beads or granules, vibrating the mould to provide a good distribution of the beads or granules with a good face where contacting the mould surface, and thereafter providing a coating for the reverse face of the moulding.

2. A method according to claim 1, wherein said coating is a further layer of a cement/aggregate mix (ie without the plastics beads or granules) cast on said reverse face and the mould is thereafter again vibrated to provide a good rear face.

3. A method according to claim 2, wherein the cast product is a slab and the first mix (including the plastics beads or granules) fills about 80% of the mould and the second mix (without the plastics beads or granules) fills the remaining 20%.

4. A method according to any one of the preceding claims wherein the vibratory periods are of the order of 5 seconds.

5. A method according to any one of the preceding claims, wherein the aggregate used is the semi-waste material supplied by the sand/gravel industry in South East England under the designation "finings" which is grit with a large proportion of smaller particles and a maximum particle size of about 6 mm.

6. A method according to any one of the preceding claims, wherein said plastics beads or granules are of expanded polystyrene.

7. A cast product produced by a method in accordance with any one of the preceding claims.

8. A method of manufacturing cast products, substantially as herein described with reference to Fig. 1 of the accompanying drawings.

9. A cast product, being a slab substantially as herein described with reference to Fig. 2 of the accompanying drawings.

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